

AN 1996:472761 HCAPLUS  
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 TI **Tin** alloy **solders** for heat exchangers  
 IN Kubota, Kohei; Ninomya, Ryuji; Myake, Koichi; Yamaguchi, Hiroshi  
 PA Mitsui Mining & Smelting Co, Japan  
 SO Jpn. Kokai Tokkyo Koho, 3 pp.  
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AB The **Sn** alloy **solders** contain 1-15% **Zn** and optionally .ltoreq.3% Cu. Alternatively, the **solders** contain **Zn** 1-15, Cu .ltoreq.3, and **Ag**, In, Sb, Ni, Fe, and/or **Bi** .ltoreq.5%. The **solders** are useful for **soldering** of Cu alloy automobile radiators and heaters.

## PATENT ABSTRACTS OF JAPAN

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(21)Application number : 06-290362

(71)Applicant : MITSUI MINING & SMELTING CO  
LTD

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(72)Inventor : KUBOTA KOHEI  
NINOMIYA RYUJI  
MIYAKE KOICHI  
YAMAGUCHI HIROSHI

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### (54) SOLDER ALLOY FOR HEAT EXCHANGER

#### (57)Abstract:

PURPOSE: To obtain a solder alloy which has excellent strength and creep strength, a lower degree of electrolytic corrosion with brass and excellent corrosion resistance by specifying the compsn. of the solder alloy for heat exchangers.

CONSTITUTION: This solder alloy for heat exchangers made of copper and copper alloy consists of 1 to 15wt.% Zn and the balance Sn exclusive of inevitable impurities. The solder alloy may contain  $\leq$  3wt.% Cu as well. The Zn is effective in improving the strength of the solder alloy and lowering the m.p. The Zn contributes to increase the creep strength as well. The effect is insufficient if the content is below 1wt.%. The m.p. rises and the wet spreadability and corrosion resistance are degraded if the content is over 15wt.%. The Cu is effective in increasing the creep strength and suppressing the phenomenon, known as solder erosion, that the fin materials, etc., of the materials to be joined melt into the solder and their thickness and strength decrease. The flow property of the solder material degrades and the use is difficult if the content exceeds 3wt.%.

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CLAIMS

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[Claim(s)]

[Claim 1] The copper and the solder for the heat exchangers made from a copper alloy which are characterized by the bird clapper from Sn except for a remainder unescapable impurity Zn1 - 15wt%.

[Claim 2] The copper and the solder for the heat exchangers made from a copper alloy which are characterized by the bird clapper from Sn except for less than [ Cu3wt% ] and a remainder unescapable impurity Zn1 - 15wt%.

[Claim 3] Zn1 - 15wt%, less than [ Cu3wt% ], the copper characterized by the bird clapper from Sn except for less than [ more than 1 sort 5wt% ] and a remainder unescapable impurity at least among Ag, In, Sb, nickel, Fe, and Bi, and the solder for the heat exchangers made from a copper alloy.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention relates to the solder for heat exchangers used for the assembly for the heat exchangers detailed copper and the detailed radiator for automobiles made from a copper alloy, for car heaters, etc. about the solder for heat exchangers.

[0002]

[Description of the Prior Art] Generally the solder material of an Pb-Sn system is used for junction of copper and the heat exchanger made from a copper alloy. In the field of the car radiator or the car heater, Pb85 - 35wt%, the 2 yuan alloy of Remainder Sn is used and many 85 - 60wt% things are used for a part especially for Pb.

[0003] However, when discarded [ that the heat exchanger using solder with much Pb is cut, or is not carried out by shredder, either, or ] by the outdoors, Pb will be eluted in soil and is a prevention-of-pollution top problem. Moreover, the joint between plate material and tube material etc. may receive thermal stress, and the defect in which carry out creep deformation, and cause severe corrosion in which the flower bloomed by the potential difference of brass and solder, and a fin separates or a tube explodes [ \*\*\*\* / causing leakage ] may be produced.

[0004]

[Problem(s) to be Solved by the Invention] Let it be the final purpose for this invention to raise the reliability of heat exchangers, such as a car radiator and a car heater, for the purpose of offering the solder for heat exchangers which was moreover excellent in intensity and creep strength as compared with Pb-Sn system solder, and was excellent in corrosion resistance with few grades of the electric corrosion between brass excluding Pb which poses such a pollution top problem.

[0005]

[Means for Solving the Problem] this invention is based on the knowledge of choosing an alloying element in detail in order to obtain the alloy which is damp in copper and a copper alloy with Sn alloy of Sn base, and gives flare nature, and attains the above-mentioned purpose.

[0006] That is, the copper of this invention and the solder for the heat exchangers made from a copper alloy are characterized by the bird clapper from Sn except for a remainder unescapable impurity Zn1 - 15wt%.

[0007] moreover, the copper of this invention and the solder for the heat exchangers made from a copper alloy - the above-mentioned composition -- in addition, Cu -- less than [ 3wt% ] -- you may contain

[0008] furthermore, the copper of this invention and the solder for the heat exchangers made from a copper alloy -- Cu -- in addition, the inside of Ag, In, Sb, nickel, Fe, and Bi -- at least one or more sorts -- less than [ 5wt% ] -- you may contain

[0009] Zn raises the intensity of a solder and has the effect which lowers the melting point. Moreover, creep strength is also raised. the content -- 1 - 15wt% -- it is 3 - 10wt% preferably As for the effect, less than [ 1wt% ] is not enough as a content, the melting point goes up [ a content ] by 15wt% \*\*, and wetting flare nature and corrosion resistance fall. Even if it adds in a large quantity further comparatively, it is rare to make potential into \*\* like Pb and to promote electric corrosion with brass. Zn will wet wet, if it is added, since weak activity flux is used when soldering for the object for electronic material or electrical and electric equipment is assumed conventionally, and I hear that its flare nature is not enough, and it has been made into tramp elements.

However, since strong activity flux is used for the assembly of heat exchangers, such as a car radiator and a car heater, although wetting flare nature falls a little compared with an Pb-Sn system, it is possible to secure the wetting flare nature of an usable grade.

[0010] Since it is effective in suppressing the phenomenon in which the fin material which is the jointed material which creep strength is made to \*\* and is called the so-called solder hoe \*\*\*\*\* melts into solder, and becomes weak thinly, Cu can be made to contain arbitrarily. the content -- less than [ 3wt% ] -- it is 0.1 - 1wt% preferably a content -- 3wt(s)% -- super- -- \*\* -- the fluidity of \*\*\*\*\* material falls and use becomes difficult

[0011] Ag, In, Sb, nickel, Fe, and Bi raise the intensity of solder material, respectively, and since In and Bi are effective in raising wetting flare nature, arbitration can be made to contain them further. The content is less than [ 5wt% ]. If a content exceeds 5wt(s)%, the meaning which an effect is saturated and is made to contain more than it will be lost.

[0012]

[Example] Hereafter, based on an example etc., this invention is explained concretely.

The alloy of examples 1-3 and 1-25 sorts of examples of comparison was first ingoted as follows.

- (1) Composition : 8.9wt%Zn, Remainder Sn, melting point:198 degree C (example 1).
- (2) Composition : 8.9wt%Zn, 0.5wt%Cu, Remainder Sn, melting point:198 degree C (example 2).
- (3) Composition : 8.9wt%Zn, 0.5wt%Cu, 0.3wt%Sb, Remainder Sn, melting point:198 degree C (example 3).
- (4) Composition : 72wt%Pb, Remainder Sn, melting point:265 degree C (example 1 of comparison), (5) composition: pure Sn, melting point:232 degree C (example 2 of comparison).

In addition, the above-mentioned melting point was respectively measured from each state diagram.

[0013] Each was cast from temperature higher 100 degrees C than the melting point to metal mold, the round bar with a diameter of 20mm was obtained, and the piece of a mechanical test etc. was extracted (sample offering sample).

[0014] \*\* For 2 and 53% of elongation with a tensile strength of 77Ns [/mm ], and the example 2, 2 and 49% of elongation with a tensile strength of 77Ns [/mm ], and the example 3 were the result of a tension test / the example 1 ] tensile-strength 2 and 55% of elongation of 25Ns/mm.

[0015] \*\* 4.7Ns /of constant stress of 2 were hung mm under 130-degree C environment, and the amount of creep elongation was measured. The diameters of the load section were 2mm and 1.5mm of parallel parts. The example 1 was extended 67 hours after, 0.26mm elongation and the example 2 were extended 67 hours after by the result 0.06mm, and although the example 3 was 0.04mm elongation 67 hours after, the examples 1-2 of comparison have been fractured within 67 hours.

[0016] \*\* From the melting point, Cu70wt% which carried flux 0.4ml which consists of saturation ZnCl<sub>2</sub> solution, a solder metal, or 0.3g (sample offering sample) of alloys on the Sn-Pb bath set as the temperature on 50 degrees C, the Zn30wt% brass board was carried, it wetted wet, and flare nature was investigated. Although wetting flare nature was most excellent in the example 1 of comparison, any solder metal or alloy was also in the good wetting state.

[0017] \*\* Hot dipping was respectively carried out to lower half 3cmx3cm of four 3cmx6cm brass boards with the solder metal or alloy (sample offering sample) of examples 1-3 and the examples 1-2 of comparison, and it was immersed in the form where each brass board is separately sunk in 5% NaCl solution for 90 hours. After the examination, the solder metal or the alloy was washed with the sulfuric acid 10%, and the corrosion weight loss was calculated. For 30mg and the example 2, 31mg and the example 3 were [ the corrosion weight loss / the example 1 / 50mg and the example 2 of comparison of 30mg and the example 1 of comparison ] 26mg. The bottom of the beaker immersed in the example 1 of comparison was notably covered with white deposit.

[0018] \*\* Two brass pieces were soldered with the solder metal or alloy of examples 1-3 and the examples 1-2 of comparison, and the superposition joint of 1cm angle was created. Since soldering conditions were made into the conditions held for 15 minutes at the temperature of +50 degrees C of melting points, they are conditions from which an alloy layer develops. The ends of brass were pulled, lengthened and removed with the tension tester, and the force was investigated. physical, since the intensity to which the soundness of an alloy layer, the shearing strength of a solder, wetting area, etc. mixed and were joined comes out -- giving the significance -- although it was difficult, for 2010 Ns and the example 3, 2050 Ns and the example 1 of comparison were [ the

result / the example 1 / 1700 Ns and the example 2 / 1690 Ns and the example 2 of comparison ] 1980Ns  
[0019]

[Effect of the Invention] As explained above, Sn alloy solder of this invention is excellent in intensity and creep strength, and there is also little corrosion by electric corrosion with brass, and since Pb was not included, when it uses for heat exchangers, such as a car radiator and a car heater, since pollution by Pb is not started but it is hard to cause accident, such as leakage of water, the heat exchanger whose reliability improved can be offered.

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**TECHNICAL FIELD**

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EFFECT OF THE INVENTION

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TECHNICAL PROBLEM

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MEANS

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